Vehicle Power Source Supporting Structure

FIELD OF THE INVENTION

The present invention relates to a supporting structure of a vehicle power source used for a vehicle body support of a vehicle power source through a plurality of mount members with elasticity.

BACKGROUND OF THE INVENTION

Conventionally as this kind of supporting structure of a vehicle power source, there are so called a gravity center mount type of supporting structure and an inertia main shaft type of supporting structure.

The gravity center mount type is a type in which a mount elasticity center is substantially accorded with a gravity center and the supporting structure in which an engine and transmission are visually placed and held on mounts provided on frame members such as the sub-frame.

When the engine is lengthwise disposed, the elasticity center in total mounts is set higher than the gravity center of the engine in many cases by tilting mounts disposed at right and left near the gravity center.

Then, as the inertia main shaft type, such a type as a plurality of mount members consisting of a front stopper disposed at a front side of an engine, a rear stopper disposed at a back side of the engine, a side engine mount disposed at a side end of the engine, a transmission mount disposed at a side end of the transmission is disclosed (for example, refer to Japan patent publication 63-55453).

Here, the front and rear stoppers are secondary weight sharing mount members which do not mainly share the weight of the engine and transmission

being a power source.

On the other hand, the side engine mount and transmission mount are primary weight sharing mount members which mainly share the weight of the engine and transmission.

FIG. 1 is a rear view showing a general configuration of conventional inertia main shaft type of a supporting structure. As shown in FIG.1, although the inertia main shaft type is generally a type of supporting structure which holds the vicinity of a torque roll shaft, mount members 101 are in many cases disposed on a side frame or at its side in the case of a layout in which an engine 102 is laterally disposed. A position of a gravity center 121 in a power source 104 which is a connected body of the engine 102 and a transmission 103 is mostly located under the side frame. Therefore, positions of a side engine mount 112a and transmission mount 112b at both sides of the power source 104 are located above the gravity center of the power source104 in many cases. Accordingly, an elasticity center of total mounts is higher than the gravity center 121 in many cases.

In the gravity center mount type of supporting structure, however, the supporting structure is a type in which the engine and transmission are placed and held on mounts provided on frame members such as the sub-frame, so the elasticity center formed by the total mounts easily becomes lower than the gravity center consisting of the engine and transmission. Therefore, the power source easily rolls and/or pitches according to movements of a vehicle.

Moreover, there is a problem that a passenger easily percepts a roll/pitch feeling of the power source and cannot get a sense of oneness of the power source and vehicle body and so a sufficient drive-safety/ride-quality feeling cannot be obtained.

On the other hand, in a conventional inertia main shaft type of supporting structure shown in FIG. 1, the mount members 101 are disposed on the side frame or at its side, so it is difficult to adopt a double vibration isolation structure such that mount members are placed and held on the side frame elastically supported by a vehicle body frame for the mount members 101 compared to the gravity center mount type. Moreover, there is a problem that routes from the side engine mount 112a and transmission mount 112b at both sides to a cabin are short, so a sound and vibration which cannot be completely shut off by the mount members 101 are easily transmitted to a passenger.

SUMMARY OF THE INVENTION

The main problem of the present invention is to provide the supporting structure of a vehicle power source in which a vibration feeling in the front/rear direction (hereinafter referred to as longitudinal direction) as well as in the right/left direction (hereinafter referred to as lateral direction) of a vehicle body can be eliminated so as to surely and sufficiently obtain a drive-safety/ride-quality feeling.

The supporting structure related to the invention is used for the support to the vehicle body of the vehicle power source through a plurality of mount members with elasticity.

The plurality of mount members consist of the primary weight sharing mount members and secondary weight sharing mount members.

Here, at least one of the primary weight sharing mount members is attached at a lower position than the height of gravity center of a power source to the sub-frame elastically supported by a vehicle body and carries out a

function mainly sharing the weight of the power source.

On the other hand, the secondary weight sharing mount members have at least one directional spring component of longitudinal and lateral directions of the vehicle body, are attached to the vehicle body at a higher position than the height of gravity center of the power source and do not mainly share the weight of the power source.

Furthermore, the height of an elasticity center as a whole is set at a higher position than that of gravity center of the power source.

Because the height of elasticity center of plurality of mount members consisting of the primary and secondary weight sharing mount members as a whole is set at a higher position than the height of gravity center of the power source, such the supporting structure enables vibration feelings in the longitudinal direction as well as in the lateral direction of the vehicle body to be eliminated.

Accordingly, the supporting structure enables a vibration isolation effect and a drive-safety/ride-quality feeling with a sense of oneness of the power source and vehicle body to be surely and sufficiently obtained.

In the secondary weight sharing mount members, the spring component elasticity of an upward /downward (vertical) direction is set to be softer than that of the longitudinal or lateral direction.

According to such the supporting structure, in the secondary weight sharing mount members elastically supporting both sides of the power source, the spring component elasticity of the vertical direction is set softer (a lower spring constant) and that of the longitudinal or lateral direction is set more rigid (a higher spring constant). Thus, the secondary weight sharing mount members enable a passenger to be difficult to percept a vibration feeling by

curbing the roll/pitch of a driving source and a vibration transmission from body side frames.

The sub-frame is supported under the body side frames through floating mounts with bolts and buffer members.

According to such the supporting structure, the sub-frame is elastically supported to the body side frames by the floating mounts. Thus, the driving source is double-elastically supported (double vibration isolation) by the primary weight sharing mounts and floating mounts.

Moreover, because the sub-frame is supported under the body side frames through the floating mounts, it breaks up, falls downward from the body side frames, and separates in the case of a vehicle collision. Therefore, a passenger compartment goes on the driving source in the case of the vehicle collision, so it can be prevented from being crushed by the driving source.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a rear view showing a general configuration of supporting structure of a vehicle power source in a conventional embodiment example.

FIG. 2A is a plan view of a supporting structure showing a general configuration of a vehicle power source related to one of embodiments of the invention.

FIG. 2B is a perspective view showing a general configuration of supporting structure of a vehicle power source related to one of embodiments of the invention.

FIG. 3A is a plan view showing a schematic configuration of supporting structure of a vehicle power source related to one of embodiments of the invention.

FIG. 3B is a rear view showing a schematic configuration of supporting structure of a vehicle power source related to one of embodiments of the invention.

FIG. 3C is a side view showing a schematic configuration of supporting structure of a vehicle power source related to one of embodiments of the invention.

FIG. 4A is a cross-section view showing a supporting structure of a floating mount at the front and back sides of a sub-frame in one of embodiments of the invention.

FIG. 4B is a cross-section view showing a supporting structure of a floating mount in between a sub-frame.

FIG. 5A is a rear view illustrating a performance of supporting structure of a vehicle power source related to one of embodiments of the invention.

FIG. 5B is a side view illustrating a performance of supporting structure of a vehicle power source related to one of embodiments of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

One of preferred embodiments of the invention will be described in detail hereinafter with reference to the accompanying drawings.

a. Supporting Structure of Vehicle Power Source

FIGS. 2A and 2B are a plan view and perspective view showing a general configuration of the supporting structure related to one of embodiments of the invention, respectively. FIGS. 3A, 3B, and 3C are a plan view, rear view, and side view showing a schematic configuration of the

supporting structure related to one of embodiments of the invention, respectively.

In the embodiment, the supporting structure is designed to be used for the support of an engine 2 which is the vehicle power source to a vehicle body 21 through a plurality of mount members 1 with elasticity.

Here, the engine 2 is designed so that a transmission 3 is connected to one end of its crank shaft (not shown in any drawing) and the crank shaft is laterally disposed for the vehicle body 21.

Such the plurality of the mount members 1 are designed to consist of primary weight sharing mount members11 and secondary weight sharing mount members 12.

These respective mount members will be described hereinafter in more detail.

b. Primary Weight Sharing Mount Members 11

The primary weight sharing mount members 11 are designed to be attached at lower positions than the height of a gravity center 31 in the engine 2 to sub-frames 22 elastically supported to the vehicle body 21, and they mainly play a role of sharing the weight of the engine 2.

Concretely, these mount members 11 are designed to consist of a rear mount 11a disposed at a front side of the engine 2 and a front mount 11b disposed at a back side of the engine 2 and a trans-lower mount (not shown in any drawing).

Through these front mount 11a, rear mount 11b, and trans-mount, the engine 2 is designed to be supported at the sub-frame 22 supported by body side frames 23 through floating mounts 13 (see FIGS. 4A and 4B).

Meanwhile, FIGS. 4A and 4B are cross-section drawings showing a

supporting structure provided between the body side frames 23 and sub-frame 22, FIG. 4A is a drawing showing the floating mount 13 disposed at the front and back sides of the sub-frame 22, and FIG. 4B is a drawing showing the floating mount 13 disposed in between the sub-frame 22. In FIG. 4A, the sub-frame 22 is supported by the body side frames 23 through the floating mount 13 having a bolt 13a and buffer rubber 13b. Although the supporting structure is also nearly same in FIG. 4B, a bracket 13c is provided in between the body frame 23 and sub-frame 22 different from FIG. 4A.

The front mount 11a, rear mount 11b, and trans-lower mount are designed to be disposed on the sub-frame 22 which is provided to support a lower arm 24 of a suspension.

The sub-frame 22, as described before, is floatingly supported under the body side frames 23 of the vehicle body 21 and the height of an elasticity center composed of the front mount 11a, rear mount 11b, and trans-lower mount is designed to be set at a lower position than the height of the gravity center 31 in the engine 2.

In fact, these front mount 11a, rear mount 11b, and trans-lower mount taking charge of supporting the self-weight of the engine 2 enable a vibration transmission of a vehicle body to be minimized because they are disposed on the sub-frame and are floatingly supported through the floating mounts 13 for the vehicle body 21 and engine vibration is double-isolated notwithstanding having a relatively high spring.

c. Secondary Weight Sharing Mount Members 12

The secondary weight sharing mount members 12 have at least one of longitudinal directional and lateral directional spring components and are designed to be attached to the vehicle body 21 at a higher position than the

height of the gravity center 31 in the engine 2.

The secondary weight sharing mount members 12 are designed not to mainly share the weight of the engine 2 different from the primary weight sharing mount members 11.

Concretely, the secondary weight sharing mount members 12 are designed to consist a side engine mount 12a which is disposed at a right side of the engine 2 and at an end opposite to the transmission 3 of the engine 2 and a trans-upper mount 12b which is disposed at a left side of the engine 2 and on the transmission 3 of the engine 2.

That is, through these side engine mount 12a and trans-upper mount 12b, the engine 2 is designed to be supported by the body side frames 23.

The side engine mount 12a and trans-upper mount 12b are designed to be disposed at a higher position for the height of the gravity center 31 in the engine 2.

Therefore, the height of an elasticity center composed of the side engine mount 12a and trans-upper mount 12b is designed to be set at a higher position than the height of the gravity center 31 in the engine 2.

As shown in FIG. 5B, these side engine mount 12a and trans-upper mount 12b enable a relatively small spring to be used and a vibration transmission to the vehicle 21 to be minimized because they work (see a black small arrow mark in FIG. 5B) as a stopper which does not take charge of supporting the self-weight of the engine 2 or a spring for a control mode for a vibratory force (see a black bold arrow mark in FIG. 5B) which is input into tires from the longitudinal direction in passing a rough road.

Then, in the case of a conventional supporting structure of a vehicle power source with only a side engine mount, a vibration in the longitudinal

direction results in becoming rather large different from the supporting structure of the vehicle power source in the embodiment (see a white arrow mark in FIG. 5B).

Moreover, in such the plurality of mount members 1, the height of an elasticity center as a whole is designed to be set at a higher position than the height of the gravity center 31 in the engine 2.

On one hand, the engine 2 is supported at the sub-frame 22 which are supported through the rear mount 11a disposed at the front side of the engine 2, the rear mount 11b disposed at the back of the engine 2, and the trans-lower mount and by the body side frames 23 through the floating mounts 13.

On the other hand, the engine 2 is supported at the body side frames 23 through the side engine mount 12a and trans-upper mount 12b disposed at the right and left sides of the engine 2, respectively.

Here as described above, on one hand, the height of the elasticity center which is composed of the front mount 11a, rear mount 11b, and trans-lower mount is set at a lower position than the height of the gravity center 31 in the engine 2.

On the other hand, the height of the elasticity center which is composed of the side engine mount 12a and trans-upper mount12b is set at a higher position than the height of the gravity center 31 in the engine 2.

Thus, the height of the elasticity center as a whole in the plurality of mount members 1 which are composed of the front mount 11a, rear mount 11b, trans-lower mount, side engine mount 12a, and trans-upper mount12b is intended to be set at a higher position than the height of the gravity center 31 in the engine 2.

As shown in FIG. 5A, when a vibratory force (see a black bold arrow

mark) acting in the lateral directions through suspensions is applied to the supporting structure, such the plurality of mount members 1 allow converting the vibration characteristics of the engine 2 into a rotational vibration about a center (see a black small arrow mark in FIG. 5A) which is higher than the height of the gravity center 31. In this way, the characteristics of vibration transmissions to the vehicle body 21 can be adapted so that the transmitted vibration can be reduced in both the direction of the vibratory force through the suspensions and a vehicle travel direction.

On the other hand, in a conventional supporting structure, of which elasticity center as a whole is set to be lower than the height of gravity center of an engine, a vibration in the lateral direction will be rather large, different from the supporting structure of the vehicle power source according to the embodiment (see a white arrow mark in FIG. 5A).

As described above, such the supporting structure results in the elimination of vibration feelings in the longitudinal dir0ection as well as in the lateral direction of the vehicle body 21 because the height of the elasticity center is designed to consist of the primary weight sharing mount members 11 and secondary weight sharing mount members 12 which are the plurality of the mount members 1 set at a higher position than the height of the gravity center 31 in the engine 2.

Accordingly, the supporting structure enables a vibration isolation effect and a drive-safety/ride-quality feeling with a sense of oneness of the power source and vehicle body to be surely and sufficiently obtained.